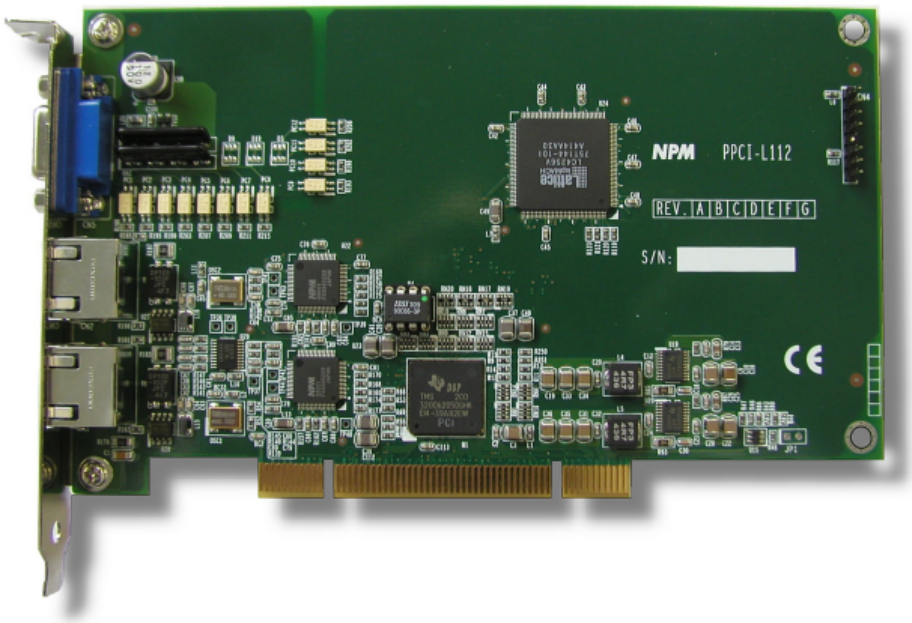
Motionnet®
Remotel/O & RemoteMotion

Center Board (PCI)

PPCI-L112

Instruction Manual



NPM
Nippon Pulse Motor Co., Ltd.

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1. Preface

Thank you for purchasing a Motionnet center board for our ultra-high speed serial communication system.

□

The PPCI-L112 is a PCI bus card for use in a PC. It is contains 2 G9001 center devices to manage the ultra-high speed Motionnet serial communication system. In addition to serial communication, it has parallel input/output lines (8 inputs and 4 outputs).
Use this board with local boards that can be controlled by serial communication.

□

Motionnet®

Motionnet is an ultra-high-speed serial communication system created by NPM (Nippon Pulse Motor). Using our four specially developed devices (G9001A, G9002, G9003, and G9004) as core chips, this serial communication system is a complete system for reducing wiring while affording remote operation by emulating a CPU and handling CPU message communications at transfer speeds of 20 Mbps. It offers all of the high-speed features and serial I/O control needed for complete motion control.

Device

G9001A: Center device

This is a central controller that manages local devices. It can be connected to any type of CPU. This device has 256 bytes of RAM for I/O control, and 512 bytes for data communication. This device can be operated from a remote CPU just like accessing memory. It can be connected to a maximum of 64 local devices (G9002, G9003, and G9004).

G9002: IO device

This is a local I/O control device that can control 32 separate I/O signals.

G9003: PCL device

This is a local device containing a pulse control LSI that has been developed and polished by NMP for use in motion control over many years. It also has a serial communication function. It can control single-axis pulse input type stepper motors and servomotors.

G9004: CPU emulation device

This is the most sophisticated local device in the Motionnet series, and it can remotely control other LSIs that need a connection to a CPU (for example a PCL6045B, made by NPM). By connecting a CPU to its local side, it can also communicate messages between CPUs.

Remote I/O

If a Motionnet line is only used for input and output control, it can send and receive signals for 2048 points on 64 local devices in 0.97msec (using a 20 Mbps data transfer speed). (If a smaller number of devices are connected, the data transfer time will be proportionally shorter.)

Remote Motion

If a Motionnet line is only used to control motors, it can control up to 64 axes. With this type of control, individual devices can control pulse-input type stepper motors and servomotors. They can execute continuous operations at constant speed, perform linear acceleration/deceleration, S-curve acceleration/deceleration, carry out preset positioning operations, and zero return operations.

A system combining these two motor types is also possible.
Although it depends on the number of devices connected and the data transfer speed selected, the cable length can be extended up to 100 m using an ordinary CAT5 LAN cable.
The serial communication uses a receive-respond type protocol. This protocol adds a CRC number to the communication frame to detect errors, thus offering higher reliability. You can use it without worrying about the accuracy of the communication.

□

This instruction manual describes the specifications and methods for using the PPCI-L112. We want you to read this manual thoroughly and get full use of the functions offered by this board.

This instruction manual does not describe the functions of the G9001A LSI for ultra-high-speed serial communication systems.
For more details about the functions and registers of this LSI, please read NPM's "Motionnet RemoteI/O & RemoteMotion G9001A/G9002 (Center device / I/O device) User's Manual."

2. Features

Data transfer speed

20 Mbps maximum

Data transfer cycle

One cycle, when connected to 64 devices using cyclic communication, takes a maximum of 0.97msec. (When the data transfer speed is 20 Mbps and our recommended 50m cable is used.)

Number of devices supported

Maximum 64 devices / line

Connection method

Multi-drop connections using LAN cables

Serial communication types

Three types of communication are available.

1) System communication

By polling the Motionnet line, the number of local devices that are connected, the device numbers, device types, and I/O port allocation status can all be checked.

2) Cyclic communication

The system starts communication with the local device that has the lowest device number. When the communication cycle reaches the device with the highest device number, the system starts over again, communicating with the device that has the lowest device number. The process of communicating with all active devices, from the lowest to the highest device, is one cycle. The system repeats this communication cycle automatically.

Cyclic communication is also used to control the I/O ports (main status data and general-purpose input/output) on the G9003.

3) Data communication

This communication type is used to handle data between a PCL device and CPU emulation device.

Write data into a FIFO in the center device, and issue a send command. This communication will be sent and received automatically by interrupting the cyclic communication.

The data communication is also used to write operation commands and registers in the G9003.

Communication error detection

Errors can be detected by adding CRC codes to the serial communication frames.

Input/output

- I/O ports: 8 inputs and 4 outputs
- Isolation: Photocouplers on both input and output terminals
- Output I/F: Photocoupler transistor output

3. Precautions

3-1. Safety Precautions

When you use this board to control a servomotor or stepper motor, take the utmost care so that no one can enter within the zone in which moving components are operated by the motor.
In addition, provide an emergency stop mechanism to stop the motor operation instantly if a person is in danger.

3-2. Handling Precautions

Inputting power

Do not connect or disconnect connectors while this board or peripheral circuits are supplied with power.

Static electricity

This board uses a CMOS device. Therefore this board must be stored in a package in which it was shipped until you actually use it, in order to prevent damage from static electricity.

Switch settings

This board is equipped with switches to set details for serial communications and input/output ports. Be sure to shut off the power supply to the board before changing these switches.

Connections to electrically noisy devices

Interference from excessively noisy devices or from power surges on the power and I/O circuits may cause the board to malfunction. To connect to a device that may generate electrical noise, we recommend taking countermeasures, such as attaching a protective circuit to the input/output circuits. However, it is best not to share the same power supply with noise generating sources.

4. Warranty period and coverage

Warranty period

12 months after being shipped from our factory.

Warranty coverage

During the warranty period, we will repair without charge any problems on the board that occurred while it was being used appropriately, and where the cause of the problem is due to us.
However, the following cases will be not be covered by the warranty, even if the warranty period has not expired.

- Problems caused by inappropriate handling or use.
- Problems caused by using parts not made or approved by NPM.
- Problems caused by modifications made to the board that were not authorized by NPM.
- Problems caused by disasters, accidents, or fires.

We warranty only the product as delivered, and we do not accept responsibility for any loss caused by a fault in our product. We will repair the board when it is sent to our plant by the user.

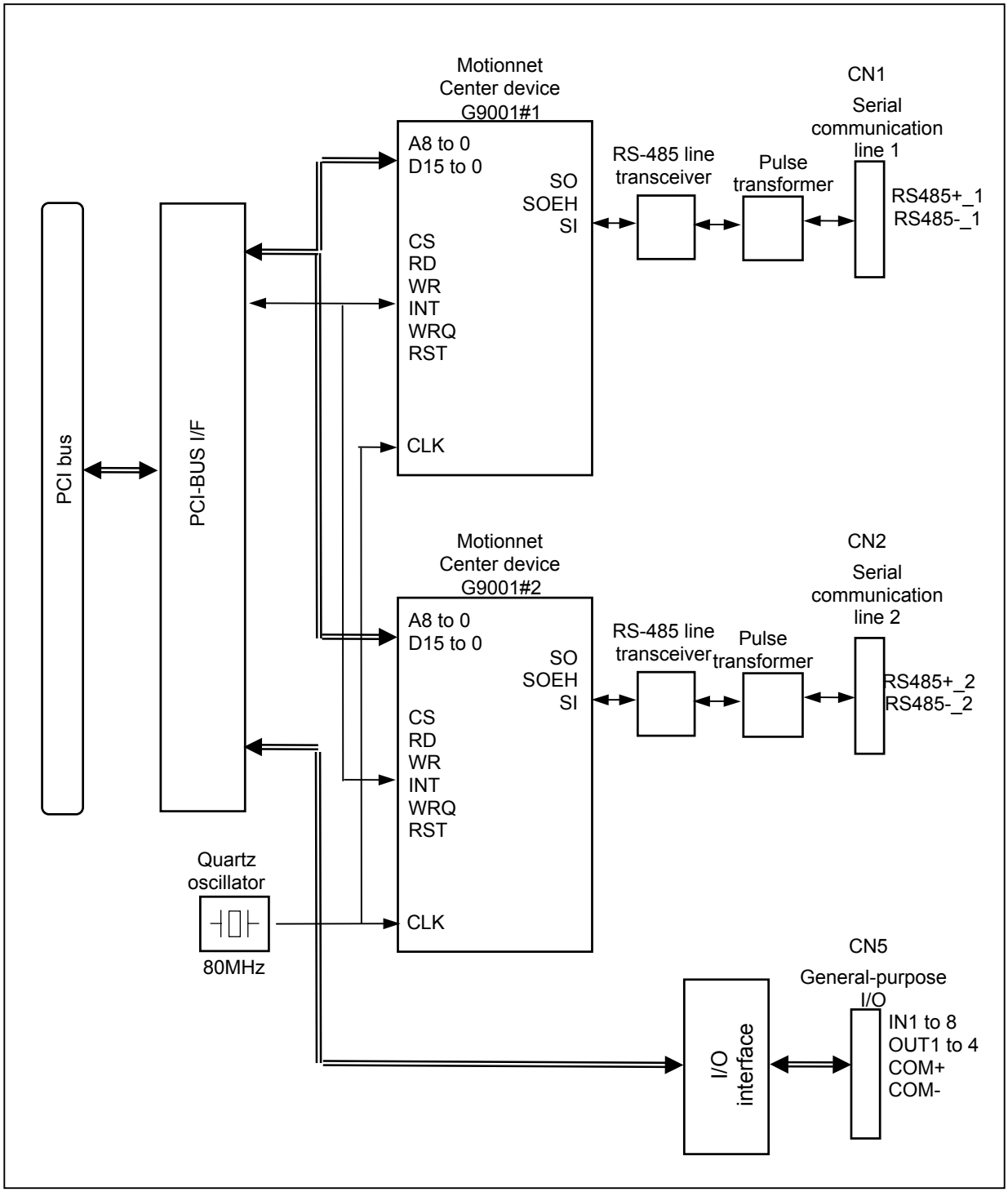
5. Specifications

Functions of this board can be classified as serial communications and motion control.

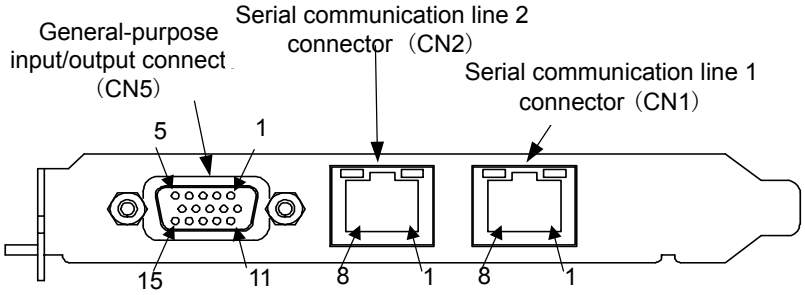
Item	Signal name	Specifications
Cyclic Communication Length		Maximum of 0.12 msec, when using 8 devices. #1 Maximum of 0.24 msec, when using 16 devices. #1 Maximum of 0.49 msec, when using 32 devices. #1 Maximum of 0.97 msec, when using 64 devices. #2 (Data transfer speed: 20 Mbps, when using our recommended cable #1: 100 m, #2: 50 m)
Total serial communication line length		Maximum of 100 m (At a data transfer speed of 20 Mbps with 32 devices connected) Maximum of 50 m (At a data transfer speed of 20 Mbps with 64 devices connected) Maximum of 100 m (At a data transfer speed of 10 Mbps with 64 devices connected) (Using our recommended cables)
Serial communication interface		Pulse transformer and RS-485 specification line transceiver
Serial communication protocol		Our proprietary protocol
Serial communication		NRZ signed
Serial communication method		Half-duplex communication
Connection method		Multi-drop connection using a LAN cable.
Serial data transfer speed		20 Mbps/10 Mbps/5 Mbps/2.5 Mbps Speed is set using a program
Serial communication status indicators		Cyclic communication LED Communication error LED
Input		- 8 terminals - Photocoupler input (supports sink type outputs) - Input signal voltage : 24 VDC - Input signal current: 4.2 mA/point (Typ.) - Response time: 55 µsec (Typ.)
Output		- 4 terminals - Photocoupler output (sink type) - Maximum rated voltage: 50 VDC - Recommending operating voltage: 5 to 24 VDC - Output current: 7 mA/terminal (Typ.) - Response time: 55 µsec (Typ.) (at 24 VDC, 7 mA load) - Output saturation voltage: Vce (sat) = 0.4 V (Max.) (Ic = 2.4 mA)
Required power		5 VDC±10%, 0.5 A(Typ.)
Operating temperature range		0 to +50˚C
Operating ambient humidity		80%RH or less (Non condensing through the 10˚C to 40˚C range)
Vibration proof		Complies with JIS C0040
Dimensions		W174.6 x H106.7 (Unit: mm) (excluding the mounting bracket)

6. Configuration

A block diagram is shown below.



7. Connector pin assignment



7-1.CN1 (serial communication line, Connector 1)

Connect Motionnet serial signal line No.1.

No.	Signal name	Function	No.	Signal name	Function
1	N.C.	-	2	N.C.	-
3	RS485+_1	Serial line 1 data +	4	N.C.	-
5	N.C.	-	6	RS485-_1	Serial line 1 data -
7	N.C.	-	8	N.C.	-

Note 1: "N.C." means no connection.

Note 2: The connector shell is attached to the mounting bracket.

7-2.CN2 (serial communication line, Connector 2)

Connect Motionnet serial signal line No.2.

No.	Signal name	Function	No.	Signal name	Function
1	N.C.	-	2	N.C.	-
3	RS485+_2	Serial line 2 data +	4	N.C.	-
5	N.C.	-	6	RS485-_2	Serial line 2 data -
7	N.C.	-	8	N.C.	-

Note 1: "N.C." means no connection.

Note 2: The connector shell is attached to the mounting bracket.

7-3.CN5 (General-purpose input/output connector)

Connect the general-purpose output signals.

No.	Signal name	Function	Direction	No.	Signal name	Function	Direction
1	IN 1	Input 1	I	2	IN 2	Input 2	I
3	IN 3	Input 3	I	4	IN 4	Input 4	I
5	COM-	Common-		6	IN 5	Input 5	I
7	IN 6	Input 6	I	8	IN 7	Input 7	I
9	IN 8	Input 8	I	10	N.C.	-	
11	OUT 1	Output 1	O	12	OUT 2	Output 2	O
13	OUT 3	Output 3	O	14	OUT 4	Output 4	O
15	COM+	Common+					

Note 1: "N.C." means no connection.

Note 2: The signal directions above refer to the signal flow direction as seen from the board: "I" = Input and "O" = Output.

Note 3: The connector shell is attached to the mounting bracket.

7-4. Connectors used

The model names of the connectors used on this board are shown below.

No.	Mfg.	Model name	Remarks
CN1	Hirose Electric	TM11R-5L-88 or equivalent	8-pin modular jack
CN2	Hirose Electric	TM11R-5L-88 or equivalent	8-pin modular jack
CN5	JAE	D02-M15SAG-20L9 or equivalent	High density, 15-pin female D-sub connector, with a retaining screw (#4-40 UNC)

This board does not come with plugs to match the connectors. Users must fabricate their own cables. We recommend the following types of plugs.

No.	Item name	Mfg.	Model name	Remarks
For CN1	Modular plug	Hirose Electric	TM11P-88P	Modular plug with shield
For CN2	Modular plug	Hirose Electric	TM11P-88P	Modular plug with shield
For CN5	D-Sub connector	Misumi	HD-15SP	High-density type, binding method
	Hood	Omron	XM2S-0913	#4-40 UNC screw

8. Signals and functions

8-1. Serial communication (RS485+_1, RS485-_1, RS485+_2, RS485-_2)

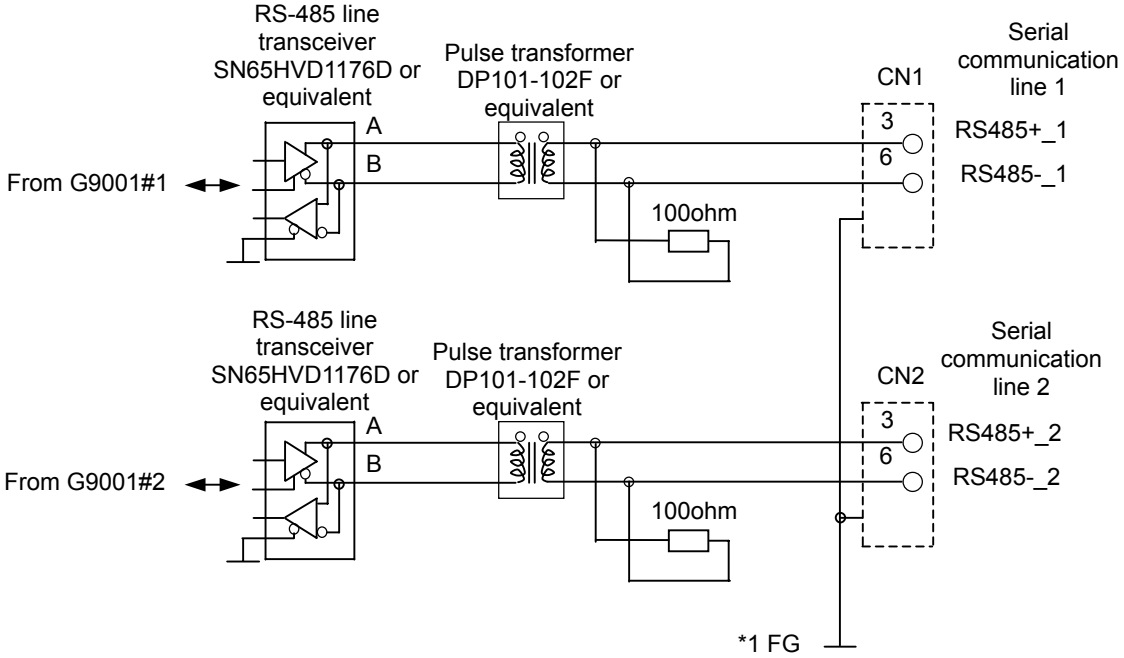
Function

Serial signals used with Motionnet.

Interface

1) The serial communication signals are isolated by pulse transformers. These are sent and received by a line transceiver with RS-485 specifications (SN65HVD1176D or equivalent).
The RS485+ terminal outputs positive phase signals and the RS485- terminal outputs negative phase signals through the line transceiver.

2) Terminating resistance
A termination resistor is installed in order to prevent reflection of the serial communication line signals.



*1. The connector frame ground (FG) is connected to the mounting bracket.

8-2. General-purpose inputs (IN1 to IN8)

Function

Supply input signals to these terminals.

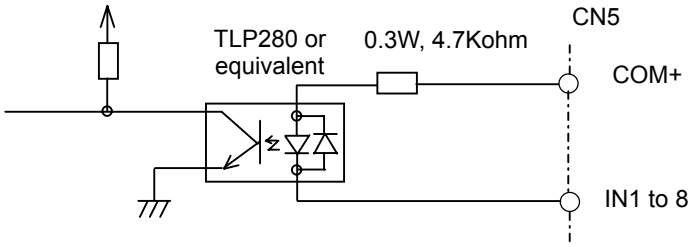
Input interface

The interfaces for these lines are photocouplers (TLP280 or equivalent).

The input logic is that when a photocoupler goes on, the signal becomes 1. (Active HIGH: Positive logic)

[Input specifications]

- Input current: 4.5mA (Typ.) (at 24 VDC)
- Response time: 55 µsec (Typ.)



8-3. General-purpose outputs (OUT1 to OUT4)

Function

These terminals supply output signals.

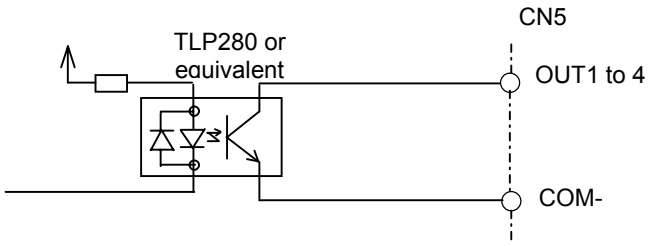
Output interface

The interfaces for these lines are photocouplers (TLP280 or equivalent).

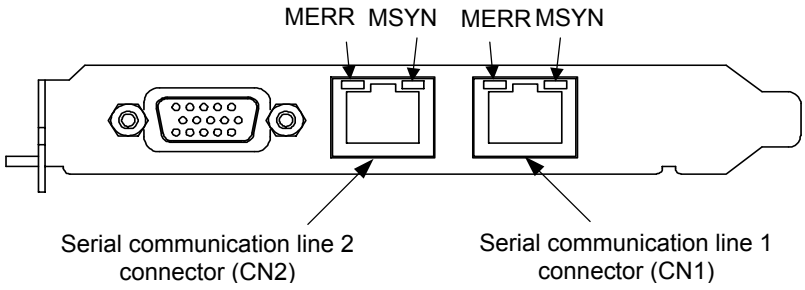
The logic is that when the photocoupler goes on, the line goes HIGH. (Active HIGH: Positive logic)

[Output specifications]

- Output withstand voltage: 80 V (Max.)
- Output current: Ic = 10 mA (Typ.)
- Low level output voltage: Vce = 0.4 V (Max.)



9. Status indicators



9-1. Cyclic communication LED (MSYN)

This LED displays the status of MSYN terminal on the G9001, and lights green at the end of each cyclic communication cycle.

9-2. Communication error LED (MERR)

This LED displays the status of MERR terminal. If the board receives an abnormal frame, this LED lights yellow.

10. Serial communication cable

This system is designed to be connected with LAN cables that guarantee enhanced quality for high-speed communication and are suitable for 100BASE and 1000BASE
These cables have well known specifications, are cheap and easily obtained close to you. Therefore, we do not include these items in our product lines and do not supply them.

To select cables you need to connect, make sure they meet the following specifications.

Wiring standard: TIA/EIA-568-B

Category 5 (CAT5)

Enhanced category 5 (CAT5e)

Category 6 (CAT6)

UTP (UnshieldedTwistedPair) cables or STP (ShieldedTwistedPair) cables that meet the specifications above. For an environment with lots of electromagnetic noise, use a shielded cable (STP).

Observe the following when connecting your system.

1) Total serial line length

This system employs a multi-drop connection method. The maximum total extension distance of the line varies, depending on the data transfer speed and the number of local boards that are connected.

- Max. 100 m (Transfer speed; 20 Mbps with 32 local boards connected)
- Max. 50 m (Transfer speed; 20 Mbps with 64 local boards connected)
- Max. 100 m (Transfer speed; 10 Mbps with connecting 64 local boards connected)

2) Minimum cable length

The shortest cable must be at least 60 cm long.

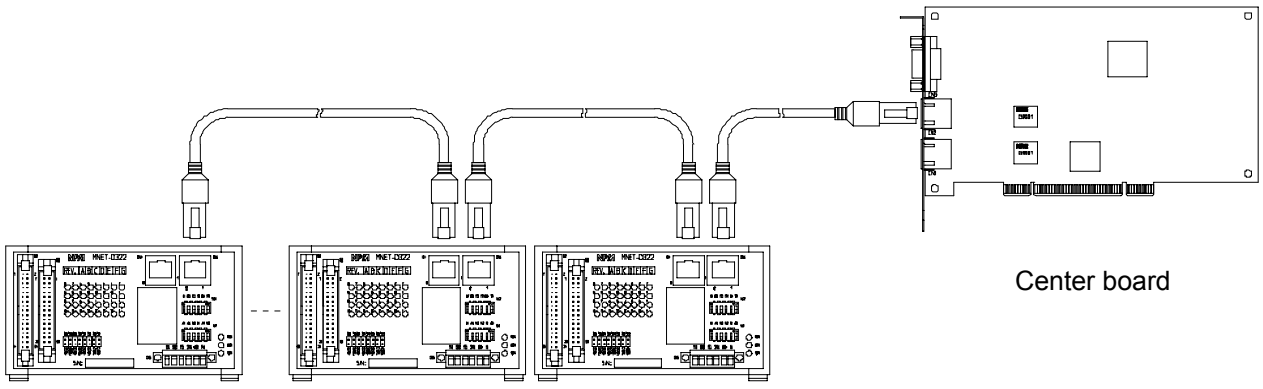
3) Do not mix cables of different types and model in the same serial line.

4) Keep the total serial line length as short as possible.

5) If you are using shielded cables, do not connect the shield on both ends to the FG terminals.

Connecting only one end of the shield on each cable will improve noise immunity.

Multi-drop connection



Center board

Local boards

11. Installation

11-1. Operating environment

Compatible OS: Windows2000, WindowsXP

11-2. Installation

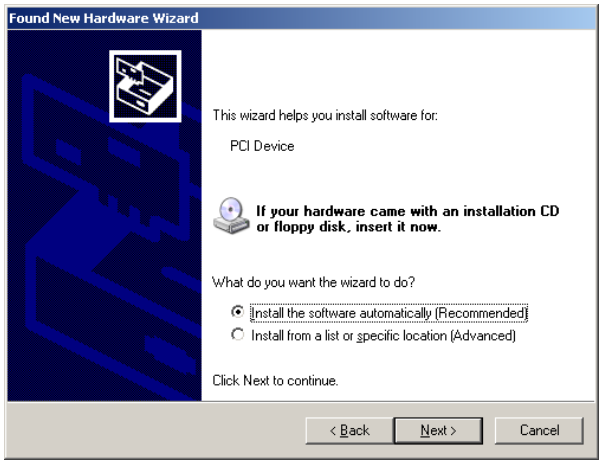
This paragraph describes the installation procedure for the device driver program.

(1) Turn off your personal computer.
(Merely turning off the power switch may still leave it charged with power. We recommend that you pull the power plug out of the power outlet.)

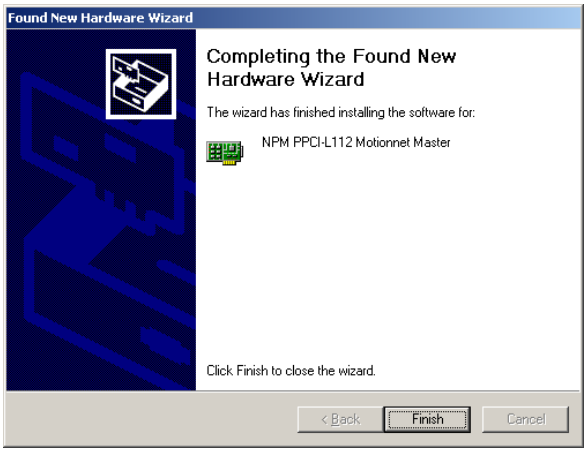
(2) Install this board in any vacant PCI slot in your personal computer.

(3) Turn on your personal computer.

Windows XP


Found New Hardware Wizard
This wizard helps you install software for:
PCI Device
If your hardware came with an installation CD or floppy disk, insert it now.
What do you want the wizard to do?
Install the software automatically (Recommended)
Install from a list or specific location (Advanced)
Click Next to continue.
< Back
Next >
Cancel

(4) A dialog box will appear to inform you that a new device has been found. A device driver installation wizard will start. Insert the CD-ROM that comes with the board into your CD drive and click the [Next] button.


Found New Hardware Wizard
Completing the Found New Hardware Wizard
The wizard has finished installing the software for:
NPM PPCI-L112 Motionnet Master
Click Finish to close the wizard.
< Back
Finish
Cancel

(5) Your PC will automatically search for the files that contain the device driver and complete the installation.

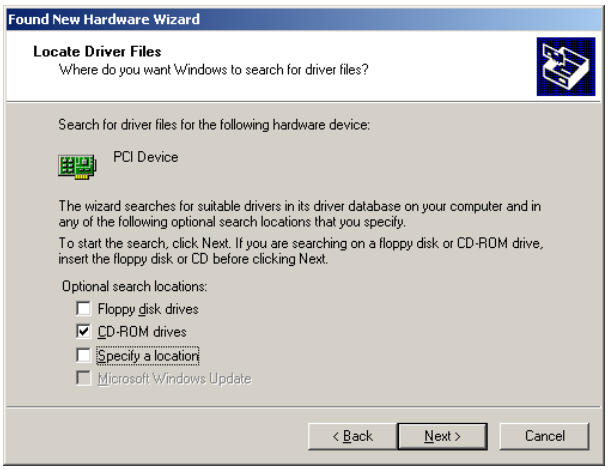
Windows2000

Found New Hardware Wizard
Welcome to the Found New Hardware Wizard
This wizard helps you install a device driver for a hardware device.
To continue, click Next.
< Back
Next >
Cancel

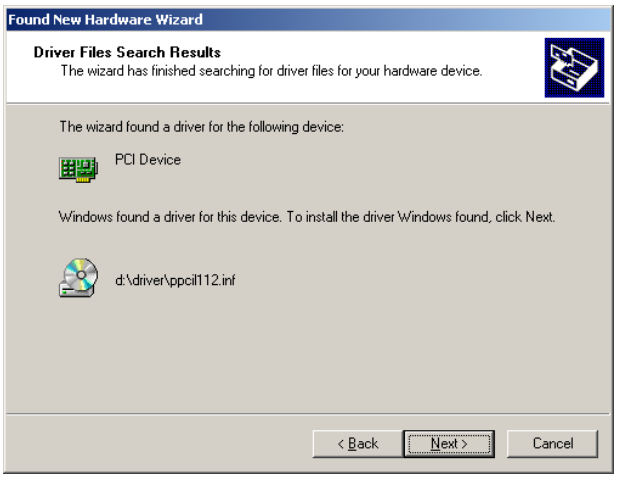
(4) A dialog box will appear to inform you that a new device has been found. A device driver installation wizard will start. Insert the CD-ROM that comes with the board into your CD drive and click the [Next] button.

Found New Hardware Wizard
Install Hardware Device Drivers
A device driver is a software program that enables a hardware device to work with an operating system.
This wizard will complete the installation for this device:
PCI Device
A device driver is a software program that makes a hardware device work. Windows needs driver files for your new device. To locate driver files and complete the installation click Next.
What do you want the wizard to do?
Search for a suitable driver for my device (recommended)
Display a list of the known drivers for this device so that I can choose a specific driver
< Back
Next >
Cancel

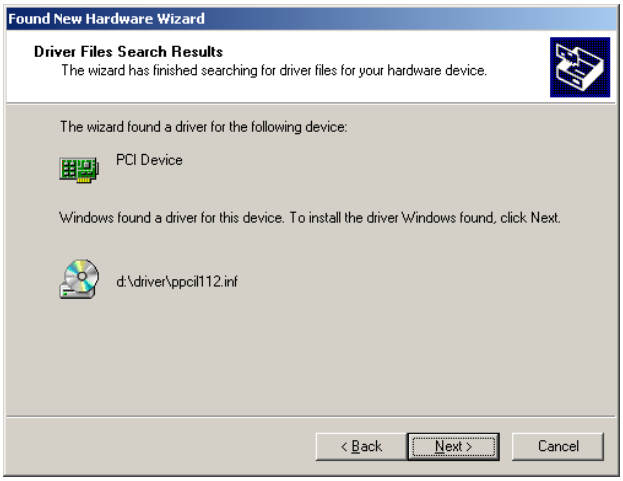
(5) Click on "Search for the suitable driver for my device" and then click the [Next] button.


Found New Hardware Wizard
Locate Driver Files
Where do you want Windows to search for driver files?
Search for driver files for the following hardware device:
PCI Device
The wizard searches for suitable drivers in its driver database on your computer and in any of the following optional search locations that you specify.
To start the search, click Next. If you are searching on a floppy disk or CD-ROM drive, insert the floppy disk or CD before clicking Next.
Optional search locations:
Floppy disk drives
CD-ROM drives
Specify a location
Microsoft Windows Update
< Back
Next >
Cancel

(6) Click the "CD-ROM drive" box and insert the CD-ROM that comes with the board into your CD drive. Then click the [Next] button.


Found New Hardware Wizard
Driver Files Search Results
The wizard has finished searching for driver files for your hardware device.
The wizard found a driver for the following device:
PCI Device
Windows found a driver for this device. To install the driver Windows found, click Next.
d:\driver\ppcil112.inf
< Back
Next >
Cancel

(7) Your PC will look for the "ppci_I112.inf" information file on the CD-ROM, as shown above. Click the [Next] button.


Found New Hardware Wizard
Driver Files Search Results
The wizard has finished searching for driver files for your hardware device.
The wizard found a driver for the following device:
PCI Device
Windows found a driver for this device. To install the driver Windows found, click Next.
d:\driver\ppcil112.inf
< Back
Next >
Cancel

(8) The device driver files are now installed and the installation process is complete.

12. Utility program

12-1. Outline of the EzLink utility

EzLink is a utility that lets you check the operation of the Motionnet system easily.
EzLink supports I/O devices and positioning devices. Using this program you can check on the addresses assigned, and which devices are connected on each serial line.
You can easily monitor and control any device you desire using the EzLink screens.

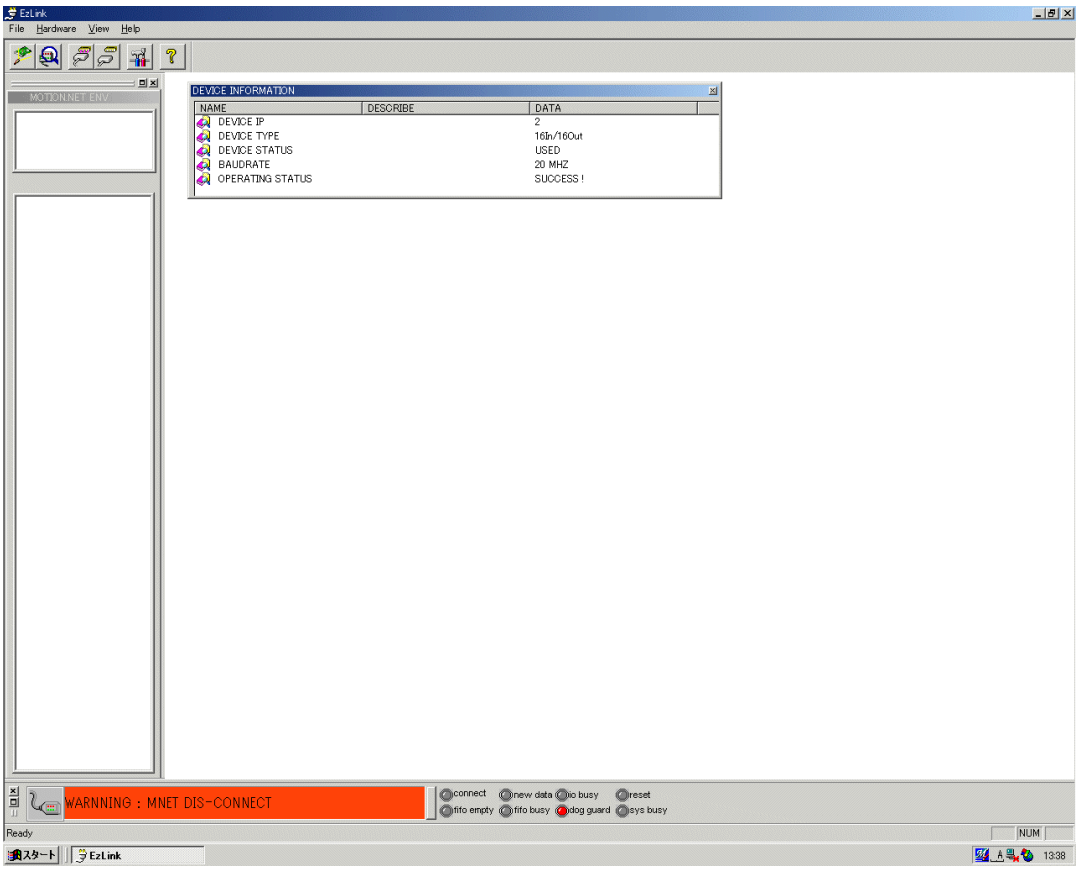
12-2. Installation

Run the "setup.exe" program in the [Install] - [EzLink] folder on the CD-ROM that come with the board.

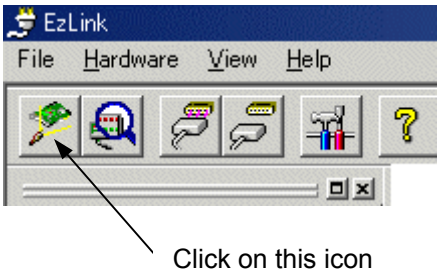
12-3.EzLink operation procedures

After starting the EzLInk program, the screen below will appear.

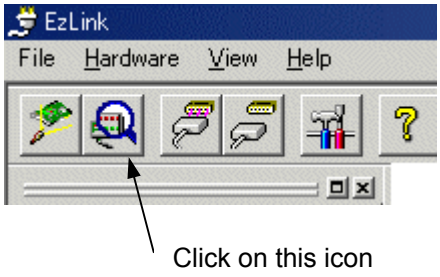
(1) Start up screen



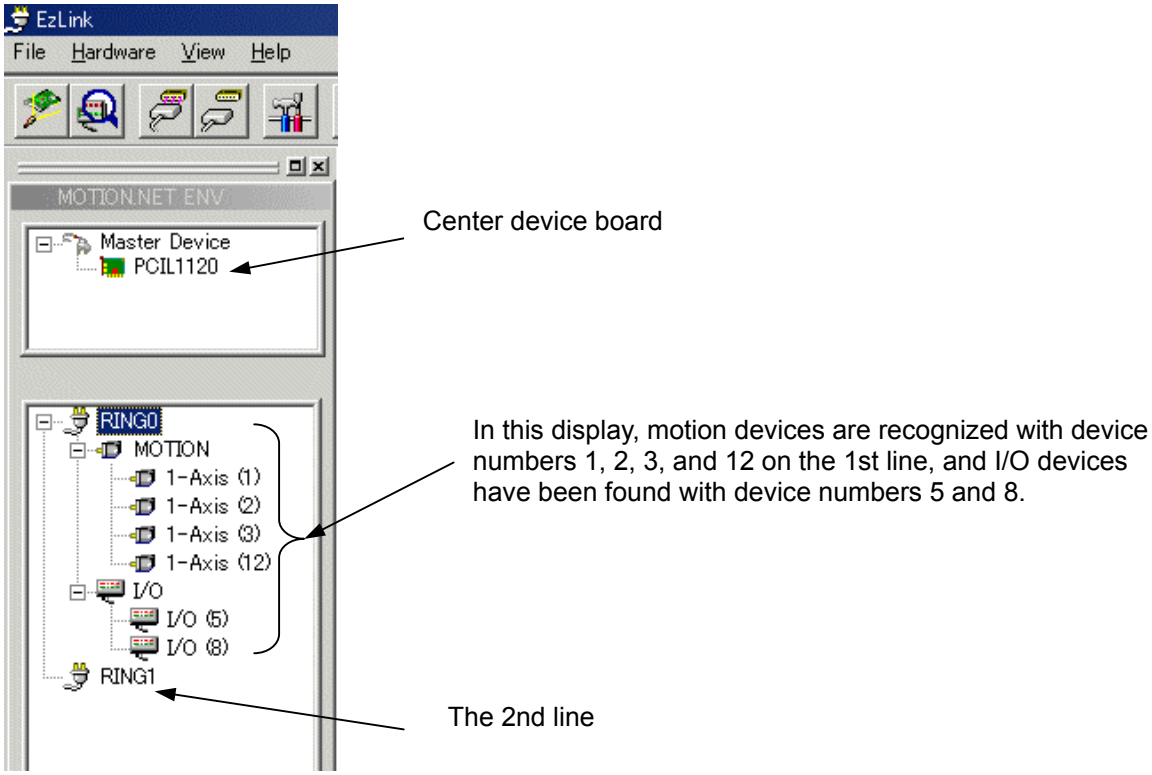
(2) Scan the center device board



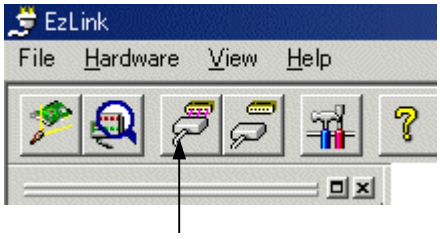
(3) Scan the local devices that are connected



When the connected devices have been identified, the screen will change, as shown below.

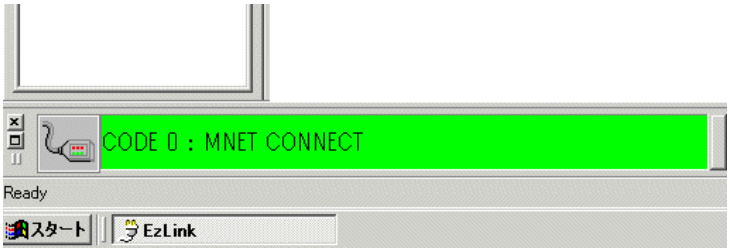


(4) Start cyclic communication

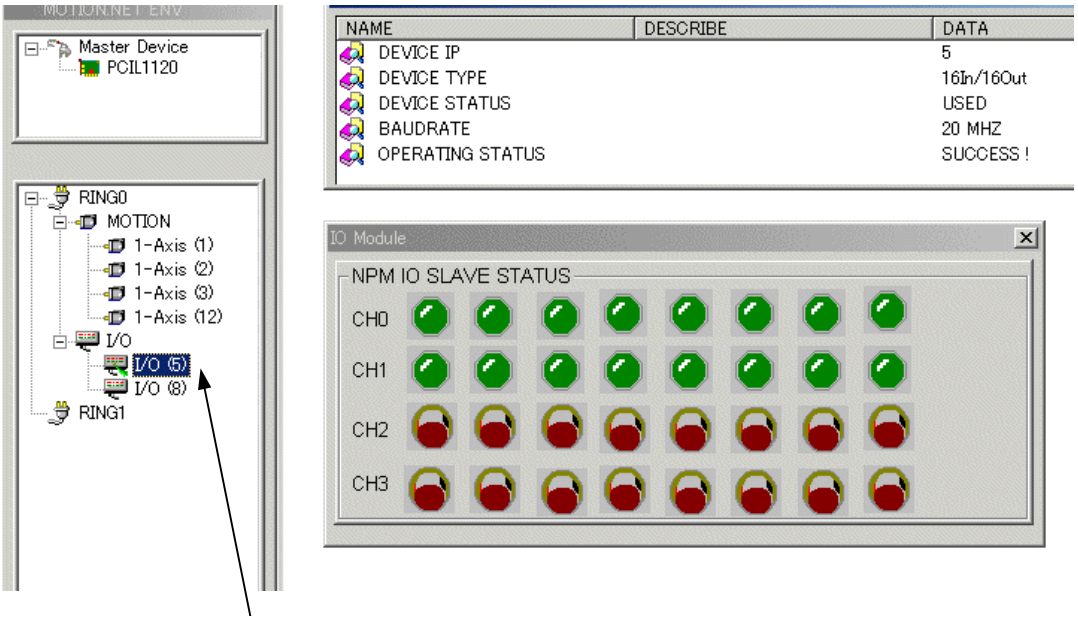


Click on this icon

When the board starts cyclic communication normally, the status area on the lower left of the screen will change, as shown below.

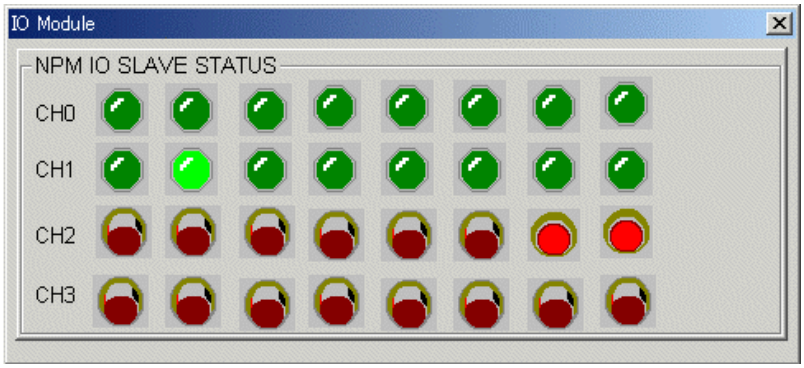


(5) Select a device



Click on the local device you want to operate or monitor and the appropriate device screen will appear.

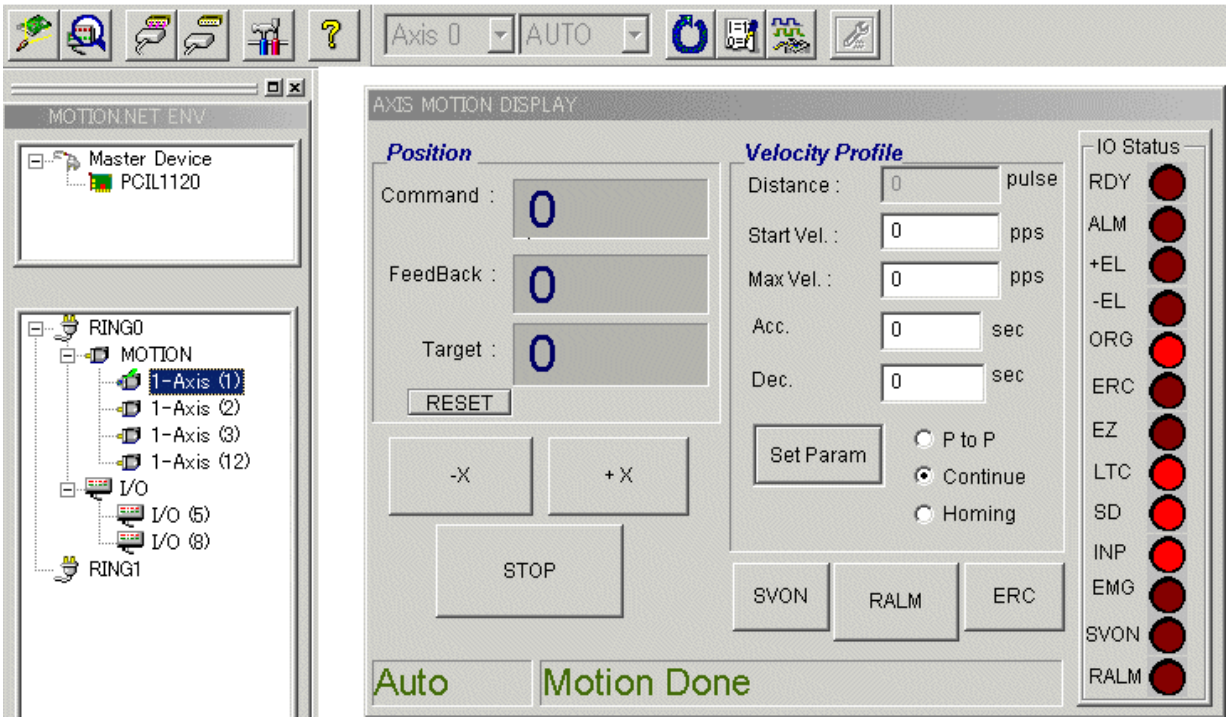
(6) Operating an I/O device



Once you select an I/O device, the screen shown above will appear.
Green lights are input ports and red lights are output ports.
The individual output ports can be turned on and off by clicking on their bits.
By turning on a bit, the indicator for that port will get brighter.

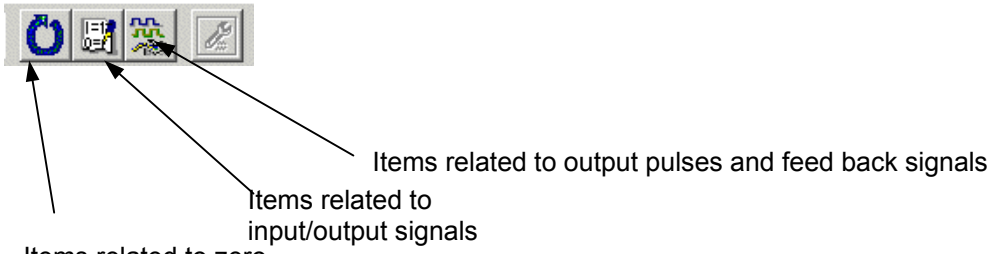
(7) Operating a motion device

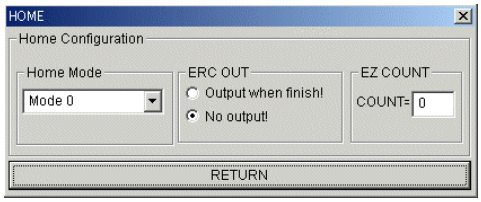
Once you select a motion device, the screen shown below will appear.
To use motion devices you have to set certain environmental items, such as the signal logic and the signal specifications, as well as various operating information such as the speed, acceleration/deceleration speed, and feed amount for the operation.



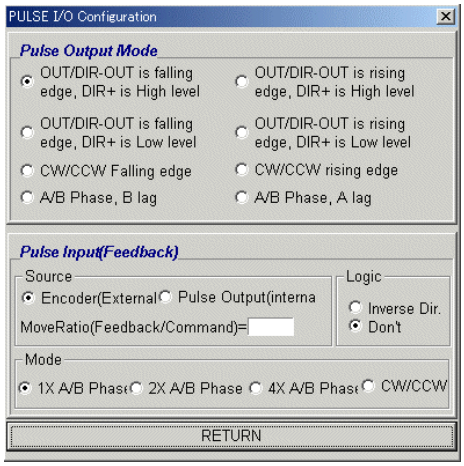
[Environmental settings]

Click on the icons along the top and the individual environment setting dialogs will appear.
Set the items in each dialog and then click on the [RETURN] button at the bottom, to confirm your settings.

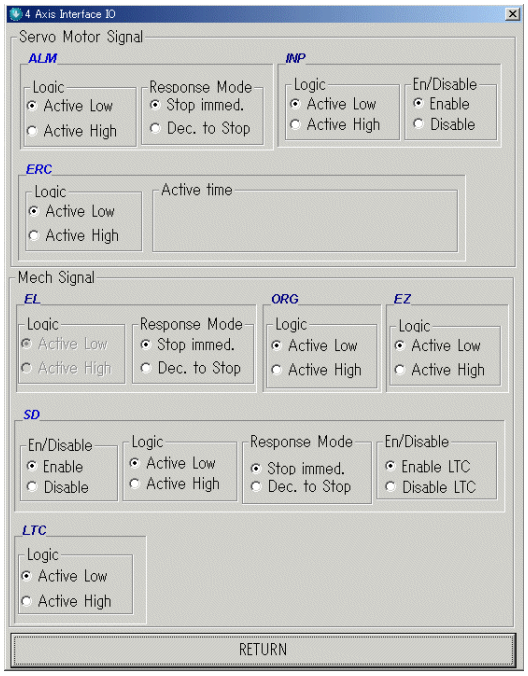

Items related to output pulses and feed back signals
Items related to input/output signals
Items related to zero return operations



Dialog box related to zero return operations



Dialog box related to output pulses/feedback signals

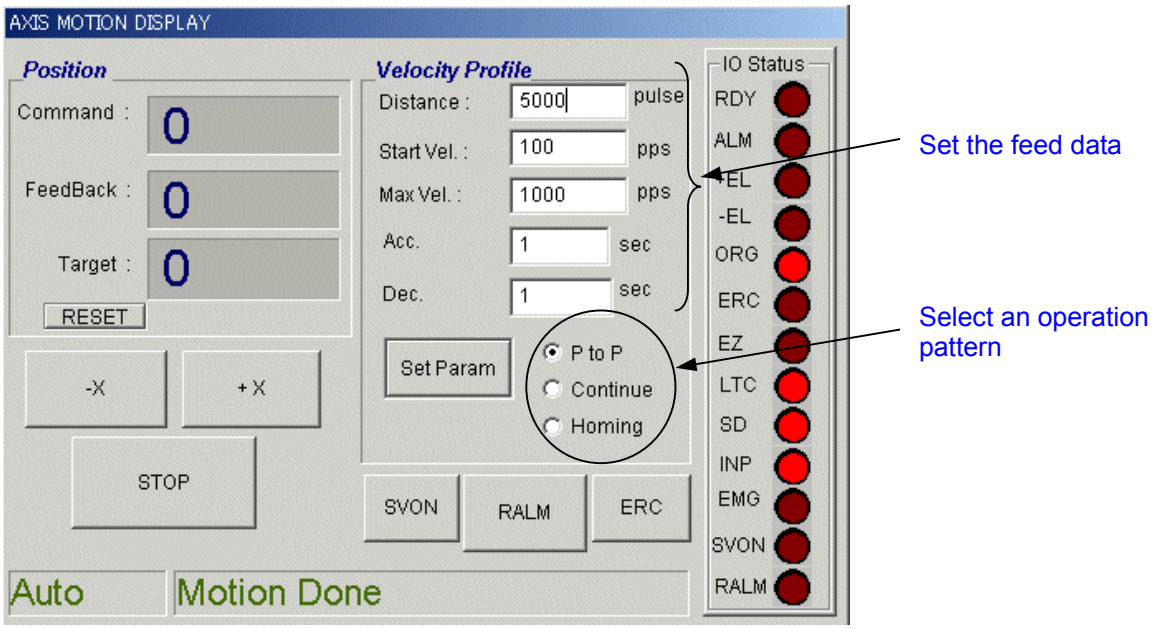


Dialog box related to input/output signals

[Setting feed data, such as the feed speed]

Enter the desired values in the boxes on the right side of the dialog box for the motion device. Then click on the [SetParam] button to confirm your changes.

However, note that the speed data shown will only be applied to the selected operation pattern.



[Operation]

Click the appropriate button to turn the output signals (SVON, ALMRES (RALM), and ERC) on and off.

You can control the output pulses by clicking on the [-X], [+X], and [STOP] buttons on the left, after you set the necessary feed data, such as the speed.

13. DLL

This board comes with two DLLs.

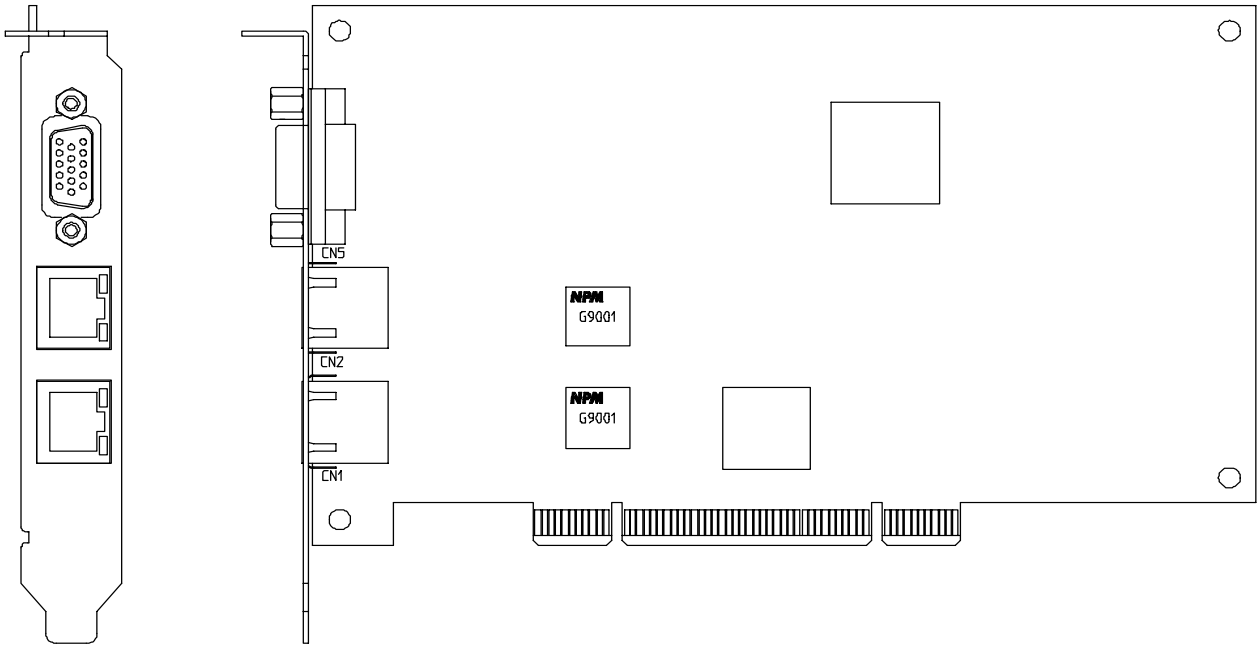
Low level DLL: This is a low level DLL that lets you read and write data by selecting an address.
To use this function, you must master the use of Motionnet LSIs.

DLL: This DLL contains multiple functions that execute low level access.
Basically, you do not need to be aware of the register level data for these operations.

- These DLLs support a maximum of 4 center device boards.
- When multiple boards are used, separate board numbers are assigned, starting with the board nearest the CPU.
  The board nearest the CPU is given number "0." Then, board numbers are assigned in ascending order.
- These files, instruction data, and sample programs are included on the CD-ROM.

14. External appearance

The external appearance of this board is shown below.



CAUTION	The descriptions in this manual may be changed without prior notice to improve performance or quality.

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